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SHORT REPORT

Urgent Endovascular Covered-Stent Treatment of Internal Carotid Artery Injury Caused by a Gunshot

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Penetrating non-lethal injuries to the distal extra-cranial internal carotid artery are often a surgical challenge, because of the difficulty of direct exposure and repair of the internal carotid artery at the skull base. We describe a case of a successful emergency treatment, with an endovascular procedure using a PTFE covered-stent, of an internal carotid artery haemorrhagic pseudoaneurysm following penetrating trauma to the neck by single gunshot,.

Keywords: Cervical trauma emergency; Carotid artery pseudoaneurysm; Covered-stent; Endovascular treatment; Arterial gunshot injury.

Introduction

The management of extracranial internal carotid (ICA) injury following penetrating trauma at the base of the skull (zone III) is challenging due to its gravity, the surgical inaccessibility and associated cerebro-cervical injuries. Chronic pseudoaneurysm is the most frequent reported lesion, but other types of carotid injury include dissection, arteriovenous fistula, thrombosis or disruption. In the case of unstable patient, with active bleeding, emergency surgical treatment is necessary, with goals of obtaining haemostasis whilst maintaining carotid flow. We present a case of a ruptured ICA pseudoaneurysm after gunshot injury in zone III of the neck, which was treated with covered-stent with a good long-term result.

Case Report

A 44-year-old man was admitted to the emergency department following a single gunshot to the right side of his neck. On admission examination, there was no focal neurological deficit (Glasgow Coma Score = 12). He was intubated rapidly because of acute epistaxis. The bullet entrance was located 4-mm inferior to his right ear. The bullet had an extra-cranial track and was still in his left mandible branch. A cervico-cerebral CT scan revealed an expanding haematoma of his left parapharyngeal space, arising from distal branches of the injured external carotid artery (ECA). There was no evidence of intracranial lesion or ICA injury. With blood transfusion and vasopressor therapy, anterior and posterior nasopharynx packing and ligation of his left ECA was performed. However, approximately 8 hours later, there was renewed bleeding. Arteriography confirmed the absence of ECA bleeding, but showed an active right ICA pseudoaneurysm with a retropharyngeal haematoma (Fig. 1).

Because of hemodynamic instability, it was decided to treat this ICA lesion with a covered-stent. A 7F sheath was positioned in the common carotid artery through a transverse cervical approach, without systemic heparinization. The ICA injury was controlled with lateral arteriography and crossed by an atraumatic hydrophylic 0.035 guidewire. A PTFE covered-stent (Advanta V12®, 5 × 38 mm, Medical Atrium Corporation, USA) was deployed immediately to

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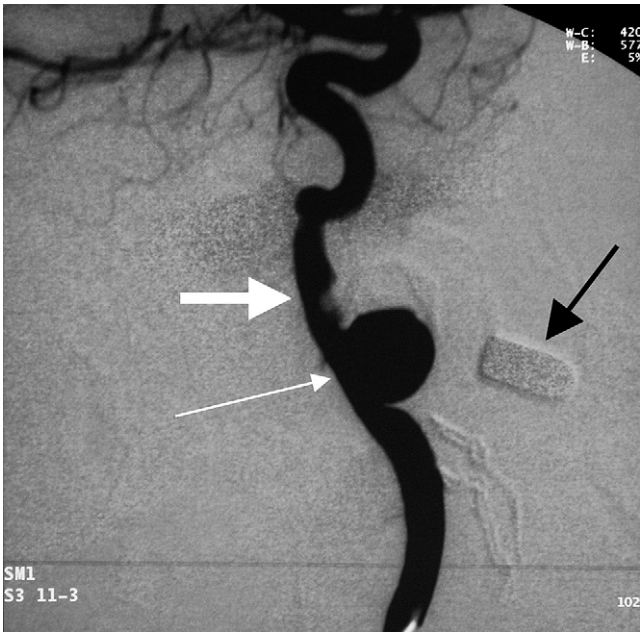

Fig. 1. Selective arteriography of the right internal carotid artery. A pseudoaneurysm can be seen arising from the ICA in zone III, located 6 mm before the carotid channel (thin arrow). The ICA was patent although there is a short anterograde dissection at the base of the skull (thick arrow). The ICA injury was done with a high velocity ballistic gunshot (6.35 mm calibre handgun) (black arrow).

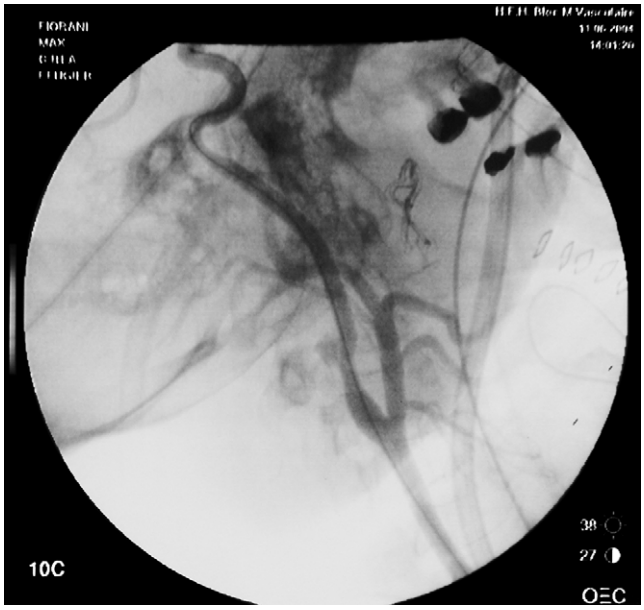

Fig. 2. Pre-operative right ICA injection after deployment of a PTFE covered-stent. The pseudoaneurysm to the zone III in the neck has been completely excluded and the retropharyngeal bleeding has been stopped.

cover the carotid injury and dissection, with 15 mm overlap on both sides. Follow-up angiography confirmed good stent position with complete exclusion of pseudoaneurysm, and extra and intra-cranial right ICA patency, without residual stenosis (Fig. 2). Removal of the posterior gauze packing and bullet was performed simultaneously, without visible bleeding.

The patient was extubated on the 4th post-operative day without either neurological deficit or further bleeding. Dual anti-platelet treatment (Aspirin and Clopidogrel) and (Enoxaparine) was started. After continued Clopidogrel treatment there was no evidence of neurological motor complication at 2 years, although the patient had become deaf in the right ear. Carotid and trans-cranial duplex-scans at 2 years confirmed the good covered-stent patency and cerebral hemodynamic, without intimal hyperplasia restenosis and with successful exclusion of the pseudoaneurysm.

Discussion

Gunshot wounds of the ICA are associated with a high mortality (18.4%), due to neurological damage associated with carotid injury and shock.[1] Acute complications can arise from haemorrhage, thrombosis, embolization or even some chronic arterial lesions. Juxta-cranial bleeding carotid wounds are difficult to control as an emergency whilst restoring or maintaining carotid flow. Therapeutic options include surgical repair with carotid-petrous bypass, ICA ligation, endovascular treatment with balloon occlusion or coil embolization.

The use of covered-stents is an attractive alternative treatment of arterial trauma, especially for carotid pseudoaneurysm complicating a blunt injury, but also for carotid injuries after gunshot injury.[2–3] Marotta *et al.* reported the first case of successful management of a pseudoaneurysm with an autologous vein-covered stent.[4] This approach allows quick, safe and minimally invasive control of actively bleeding carotid injury, even at the base of the skull or when the both ICAs are injured.[2]

We deployed a PTFE covered-stent in order to minimise the post-operative hyperplasia and infection risks.[3] No distal embolization occurred. The success was confirmed by good functional recovery and duplex demonstration of long-term patency of the covered-stent, without restenosis.

Our successful case, adds to previous reports, to demonstrate that treatment of post-traumatic distal carotid wound with a covered-stent may be the optimal management.

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